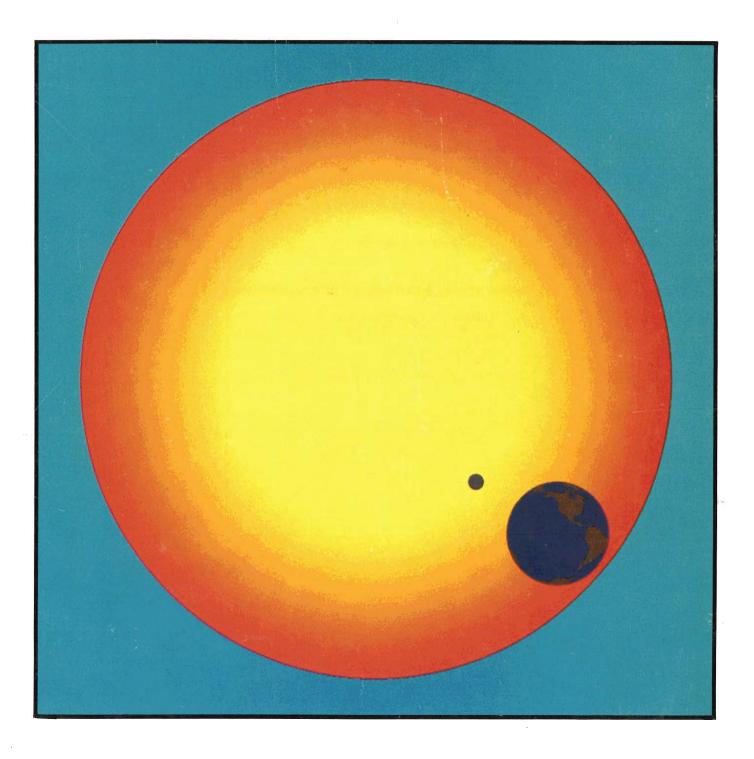
# Science Los Alamos NATIONAL LABORATORY







On the cover: Artist's conception of the sun, earth, uniformly to produce a full spectrum of color and package developed at Los Alamos. intensity.

Overstriking concentric circles of full-intensity red and and moon before a solar eclipse. This computer-graphic green delineates the sun's yellow center; the outer regions illustration was created using a color-mixing subroutine of the sun were created by selectively removing green with developed by Rongriego. The subroutine compensates for a cosine distribution. Selective blanking protected the the nonlinear response characteristics of an FR80 micro- emulsion where the earth and moon were to be exposed film recorder to provide a perceptibly linear intensity on the film. These images, generated in separate files, gradation. Saturation problems are eliminated and the were then projected into the protected areas. The resultant additive colors, red, green, and blue may be mixed slide was produced using MAPPER, a graphics software



Volume 2, Number 1, 1981

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# alogue • dialogue • dialogue

### HIGH-TEMPERATURE SUPERCONDUCTIVITY

In the first issue of LASL Science, we reported an enormous lattice softening in Ir-Y alloys, which reached a minimum near the eutectic composition. This softening had implications for superconductivity which were thoroughly discussed in our article.

We have now turned our attention toward the metastable alpha prime phase of plutonium, in which up to 1.7 at.% aluminum (normally insoluble in the alpha lattice) has been entrapped by a pressure induced martensitic phase transformation. This entrapment of aluminum into the alpha-plutonium lattice causes profound alterations in the thermal, elastic and mechanical properties of the material. Two of these results—an increased compressibility (measured by sound speed and by mechanical compression tests) and a concomitant anomalous expansion of the lattice—had led previous investigators to believe that the lattice was probably softened through an electronic change in the plutonium 5f electron bonding characteristics.

We felt we could quantitatively investigate (and perhaps further understand) this softening using again the technique of small sample calorimetry discussed in the superconductivity article, (LASL Science 1980). Therefore a 15 mg foil of Pu-1.7 at.% Al was prepared and measured at low temperatures to determine the Debye temperature, a measure of the lattice stiffness. Our results show that the entrapment of 1.7 at.% aluminum into the plutonium alpha lattice reduces the Debye temperature of that lattice by an amazing 30%.

Thus, we have been able to verify in a quantitative manner the degree of softening of the plutonium alpha-phase lattice into which foreign aluminum atoms have been trapped. The question remains however: Why does aluminum weaken the bonds in the alpha-plutonium lattice? We plan to continue our work to dig deeper into this problem.

G. R. Stewart, R. O. Elliott, and B. T. Matthias

#### ON THE FIRST ISSUE

As an editor of a number of international scientific journals and someone who has been associated with scientific publishing for a long time, I write to congratulate you on Volume 1, No. 1 of your new publication. It is clearly a much superior publication to any of those put out as yet by the other national laboratories, and will clearly hold its own with any publication in the world market.

This is a major accomplishment for the first issue of any journal, and I can only congratulate you and wish you every success in maintaining this excellent standard in the issues that lie ahead.

Your mix of articles and the obvious careful editorial work that shows in them is both a tribute to the scientific work at Los Alamos and to the care that went into the production of this first issue.

Having said this about the magazine as a whole, let me in particular congratulate Mitchell J. Feigenbaum on his article entitled, "Universal Behavior in Non-Linear Systems." This is by a

large measure the clearest exposition of the most recent work leading toward an understanding of turbulence that I have yet found, and I much appreciated it.

D. Allan Bromley, DirectorA.W. WrightNuclear Structure LaboratoryYale University

I found the first issue of "Los Alamos Science" both interesting and useful and look forward to future issues. At first I was slightly disturbed by what seemed to be a conflict between "pop feature" layout and almost academic text—as if the illustrations were both out of style and scale. But, hats off to you, the content is good. I like it.

Anthony Tucker Science Correspondent The Guardian, Manchester, England

I wish to congratulate you on the publication of the first issue of "Los Alamos Science."

I enjoyed reading this copy of your excellent magazine and look forward to receiving future issues.

David A. Shirley, Director LBL

Got your first issue of Los Alamos Science. It is great! Congratulations!!

Harold M. Agnew President, General Atomic Company

Your comments on articles appearing in Los Alamos Science are welcome. Please address c/o The Editor, Los Alamos Science, Mail Stop 399, P. O. Box 1663, Los Alamos, NM 87545.

## Inside this Issue

"The endeavor is not, as is sometimes thought, a way of building a solid, indestructible body of immutable truth, fact laid precisely upon fact in the manner of twigs in an ant hill. Science is not like this at all: it keeps changing, shifting, revising, discovering that it was wrong and then heaving itself explosively apart to redesign everything. It is a living thing, a celebration of human fallibility. At its very best, it is rather like an embryo."

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cience, a celebration of human fallibility—how refreshing is this phrase in an age when scientists are asked for sure answers and dare not admit the virtue of their uncertainty. But uncertainty is surely a theme of science, and a theme of this issue as well. From nonlinear studies, which are just in their infancy, to the age-old search for fundamental building blocks of nature, from exploring the solar corona to unfolding its influence on the earth's atmosphere, scientists struggle to enlarge the fragile tissue of interconnected ideas. We are gratified to see these efforts encouraged at a time when pragmatic concerns weigh so heavily.

One embryo in this struggle will develop at the Los Alamos Center for Nonlinear Studies. The Center will coordinate research on erratic and complex phenomena that appear in different forms in almost all areas of science and present major stumbling blocks to the success of advanced energy technologies. One of the Center's first projects may be to explore these phenomena as they relate to detonation of high explosives, a topic of continuing study at this Laboratory but, as described in this issue, still more of an art than a science. Another embryo will be fostered by the

Los Alamos branch of the Institute of Geophysics and Planetary Physics; here scientists from University of California and Los Alamos National Laboratory can form new collaborations on problems in solar-terrestrial physics.

These efforts can flourish only in a supportive environment created by strong leaders who know the nature of the endeavor and all of its risks. Peter Carruthers, former Theoretical Division Leader and currently Senior Fellow of the Laboratory, discusses the subtle role of leadership in science in an unusual and personally revealing interview.

Finally, we focus on neutrino experiments that may reshape our understanding of the universe and the fundamental forces within it.

Altogether, this second issue of Los Alamos Science is in itself a celebration, a celebration of the continuing human endeavor we call science.

Weia Krant Cooper

Lewis Thomas, "On the Uncertainty of Science," Harvard Magazine September-October 1980. Reprinted with permission. Lewis Thomas, author of The Lives of a Cell and The Medusa and the Snail, is now chancellor of the Memorial Sloan-Kettering Cancer Center in New York.